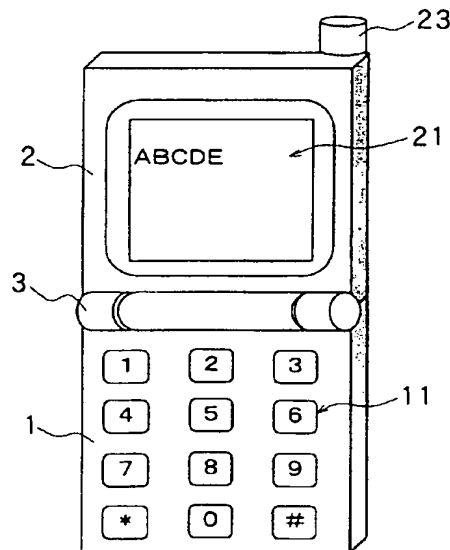




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(54) **TELEPHONE PORTATIF REPLIABLE**
(54) **FOLDABLE PORTABLE TELEPHONE**

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(57) In a foldable portable telephone comprising a main body case and a lid case openably connected thereto, the main body case is provided with a manual key arrangement on an inner surface thereof, and the lid case has a liquid crystal display device incorporated therein. The lid case has an inner surface including an inner display surface opposed to an image display screen of the display device, and a rear surface including an outer display surface opposed to an image display screen of the display device. A display pattern of the display device is displayed as reversed in response to the lid case to be opened or closed to enable the user to observe normally a display image of the display device through either of display surfaces. Thus, information given by the caller can be recognized upon receiving a call.

ABSTRACT

In a foldable portable telephone comprising a main body case and a lid case openably connected thereto, the main body case is provided with a manual key arrangement
5 on an inner surface thereof, and the lid case has a liquid crystal display device incorporated therein. The lid case has an inner surface including an inner display surface opposed to an image display screen of the display device, and a rear surface including an outer display
10 surface opposed to an image display screen of the display device. A display pattern of the display device is displayed as reversed in response to the lid case to be opened or closed to enable the user to observe normally a display image of the display device through either of
15 display surfaces. Thus, information given by the caller can be recognized upon receiving a call.

TITLE OF THE INVENTION

FOLDABLE PORTABLE TELEPHONE

FIELD OF THE INVENTION

5 The present invention relates to foldable portable telephones comprising a main body case and a lid case openably connected thereto.

BACKGROUND OF THE INVENTION

 Foldable portable telephones comprise a main body
10 case and a lid case which are foldable into a compact form for carrying and which are opened for communicating speech to expose a manual key arrangement provided on the inner surface of the main body case and a display screen provided on the inner surface of the lid case for
15 manipulating keys or displaying telephone numbers, etc. Such a foldable portable telephone is not only convenient to carry but also free of the likelihood that some keys will be inadvertently depressed when the telephone is carried as placed in a bag or the like since the manual
20 keys are then covered with the lid case.

 However, conventional foldable portable telephones have the problem that when a call is received by the

telephone, the user is unable to immediately read the telephone number of the caller and other information given on the display screen by the incoming call because the display screen does not appear unless the lid case is
5 opened.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a foldable portable telephone which enables the user to view the information given by the caller upon receiving a
10 call.

The present invention fulfills the above object by utilizing the inherent construction of a liquid crystal display device, i.e., the construction of a transparent or semitransparent image display screen which comprises a
15 liquid crystal material and which enables the viewer to observe images on the display screen from both the front side and the rear side thereof.

The present invention provides a foldable portable telephone comprising a main body case and a lid case
20 openably connected thereto. The main body case is provided with a manual key arrangement on the inner surface thereof, and the lid case has a liquid crystal

display device incorporated therein and comprising a transparent or semitransparent image display screen as described above. The lid case has an inner surface including an inner display surface opposed to the screen of the display device. The lid case has a rear surface including an outer display surface opposed to the screen of the display device. A display pattern of the display device is displayed as reversed in response to the state of the lid case to be opened or closed, to enable the user to observe normally the display image of the display device through either of the display surfaces.

When a call is received by the foldable portable telephone of the invention to its state wherein the lid case is open, a display pattern including the telephone number, etc. of the caller is produced in the display device, and presented in the image display screen by the same processing as in the prior art. As a result, the telephone number, etc. of the caller is presented normally in the inner display surface of the lid case as in the prior art.

On the other hand, when a call is received to its state wherein the lid case is closed, a processing is

performed to have the display pattern of the display device in its open state of the lid case displayed as reversed. Thus, a produced display pattern is produced in line symmetric relationship with the display pattern
5 wherein the lid case is open, and presented in the image display screen. The presented display pattern is observed normally in the image display screen of the display device through a rear surface, and the telephone number of the caller, etc. is presented normally on the outer
10 display surface.

According to an embodiment of the invention, the main body case or the lid case comprises a folding detection switch which is turned on / off in response to the lid case to be opened or closed. A display pattern of
15 the display device is automatically displayed as reversed according to on / off signal of the folding detection switch. With this embodiment, the folding detection switch is turned on / off in response to the lid case to be opened or closed to have the display pattern of the
20 display device automatically reversed, so that the normal display is presented on the inner display surface only if the user opens the lid case when he views the outer

display surface with the lid case closed.

Thus upon receiving a call, the foldable portable telephone of the present invention enables the user to view information such as the telephone number of the caller without opening the lid case.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1(a) is a perspective view showing a foldable portable telephone embodying the invention as it is opened;

10 FIG. 1(b) is a perspective view showing the telephone as it is closed;

FIG. 2 is a side elevation showing the interior construction of the telephone;

15 FIG. 3 is a view in section showing the construction of a liquid crystal display device;

FIG. 4 includes diagrams showing a plurality of pixels forming an image display pattern as reversed;

FIG. 5 is a flow chart showing an operation in response to an incoming call; and

20 FIG. 6 is a diagram showing two image display patterns produced on the liquid crystal display device according to the lid case to be opened or closed.

DETAILED DESCRIPTION OF EMBODIMENT

An embodiment of the present invention will be described below in detail with reference to the drawings. FIGS. 1(a) and 1(b) show a foldable portable telephone embodying the present invention and comprising a main body case 1 and a lid case 2 connected to the case 1 by a hinge mechanism 3. The telephone can be opened to a state wherein the lid case 2 is open as shown in FIG. 1(a) and closed to a state wherein the lid case 2 is closed as shown in FIG. 1(b). The main body case 1 has an inner surface provided with a manual key arrangement 11. The lid case 2 has a liquid crystal display device incorporated therein, an inner surface including an inner display surface 21 for observing therethrough an image display of the liquid crystal display device, and a rear surface including an outer display surface 22 for observing therethrough the image display of the device. The lid case 2 has an antenna 23 projecting therefrom.

With reference to FIG. 2, arranged in the interior of the main body case 1 are a control circuit board 6, radio circuit board 61, battery 62 serving as a power source for these circuit boards, and a microphone 12. On

the other hand, a liquid crystal display device 4 is disposed inside the lid case 2 as described above. A protective glass panel 5, 51 is provided facing opposite surfaces of the display device 4. Thus, the inner
5 protective glass panel 5 forms the inner display surface 21, and the rear protective glass panel 51 forms the outer display surface 22. Disposed on the interior of the lid case 2 are a liquid crystal display driver 8, speaker 24, and folding detection switch 7.

10 The liquid crystal display device 4 has the same construction as in the prior art. With reference to FIG. 3, the device 4 comprises a liquid crystal material 41, X electrodes 42 and Y electrodes arranged with a predetermined pitch respectively on opposite sides of the
15 liquid crystal material 41, and two polarizers 46, 47 disposed respectively on the outer sides of the electrode arrangements, with a glass plate 44 or 45 interposed between each polarizer and the corresponding electrode arrangement. The two polarizers 46, 47 are used in
20 combination with their polarization directions positioned orthogonally to each other, and the molecules of the liquid crystal material 41 are twisted through 90 degrees

as positioned between the two polarizers 46, 47. With no voltage impressed across the X electrode 42 and the Y electrode 43, light is propagated as twisted through 90 degrees along the twist of the liquid crystal molecules and therefore passes through the polarizers 46, 47. However, voltage applied eliminates the twist of the liquid crystal molecules, with the result that light fails to pass through the polarizers 46, 47. Utilizing these phenomena, the device 4 displays images on the display screen provided by the liquid crystal material 41.

With the liquid crystal display device 4, therefore, the image display screen provided by the liquid crystal material 41 is transparent, and the images displayed on the screen can be observed from both the front side and rear side thereof.

Further with the display device 4, the intersection of a pair of X electrode 42 and Y electrode 43 serves as one pixel, and one character can be formed by a plurality of pixels as seen in FIG. 4(a). For example, in the case where the character "a" is to be displayed on the screen which is to be observed from the front side thereof, a usual display pattern is produced as shown in FIG. 4(a).

On the other hand, when the display device 4 is reversed by turning upside down to observe the device 4 from the rear side thereof, as shown in FIG. 4(b), the display pattern is reversed in symmetric relationship about a horizontal line, whereby the character "a" can be observed normally even when the device 4 is reversed by turning upside down.

With the foldable portable telephone of the invention, when the user observes the image on the inner display surface 21 with the lid case 2 open, as seen in FIG. 1(a), the usual display pattern is produced as in the prior art. With reference to FIG. 1(b), when the user observes the image on the outer display surface 22 with the lid case 2 closed, the display pattern as reversed is produced on the liquid crystal display device as described above. This enables the user to observe the image in normal position regardless of the state of the lid case.

FIG. 5 shows the operation to be performed when a call is received by the foldable portable telephone. When the call is received in step S1, step S2 prepares a usual display pattern representing information which

indicates the telephone number of the caller and the reception of the call, and thereafter the folding detection switch is checked whether it is on or off in step S3. If the lid case is opened, the folding
5 detection switch is found off followed by step S7 transmitting the data constituting the display pattern to the display driver. As a result, the image is presented on the display device to enable the user to observe the image through the inner display surface 21 in step S8.

10 On the other hand, when the lid case is closed in step S3, the folding detection switch is found on, and then step S4 follows to have the display pattern reversed. Step S5 follows to transmit the data constituting the reversed display pattern to the liquid crystal display
15 driver. Consequently, in step S6 the image is displayed on the display device, and the image can be observed normally through the outer display surface 22.

Further, in the case where a call is received with the lid case closed and then the lid case is open, step
20 S6 follows step S7 and the display pattern returns to the normal pattern to be presented on the liquid crystal display in step S8.

FIG. 6 (a)(b) show an example of the display patterns produced on the display device 4 with the lid case 2 open and an example of the display patterns on the display device 4 with the lid case 2 closed, and each of which is observed through the front surface of the display device 4. As shown in FIG. 6(b), whereas the display pattern is reversed with the lid case 2 closed, the pattern can be observed normally through the outer display surface 22.

Upon receiving a call, the foldable portable telephone of the invention enables the user to view the telephone number of the caller, etc. without opening the lid case as described above, and is therefore convenient. Further the invention wherein the single liquid crystal display device 4 is used to provide the inner display surface 21 and the outer display surface 22 results in a lower cost and a smaller space than the use of two liquid crystal display devices for providing an inner display screen and an outer display screen.

The telephone of the present invention is not limited to the foregoing embodiment in construction but can be modified variously by one skilled in the art

without departing from the spirit of the invention. The control circuit board 6 or liquid crystal display driver 8 is operated for producing a reversed image display pattern for presentation on the openable lid case.

5 Whereas the image display pattern of the display device is reversed with the lid case closed according to the procedure of FIG. 5 (step S4), it is alternatively possible to produce an image display pattern which is observed normally through the outer display surface 22 in
10 the display device with the lid case 2 closed and to reverse the display pattern by opening the lid case 2.

With the construction shown in FIGS. 1(a), 1(b) and 2, the display device 4 is turned upside down and reversed by opening the lid case 2 so that the image
15 display pattern is reversed in symmetric relationship about a horizontal line, whereas if the display device is adapted to be turned laterally and reversed by opening the lid case, the image display pattern may be reversed in symmetric relationship about a vertical line.

What is claimed is:

1. A foldable portable telephone comprising a main body case and a lid case openably connected to the case, the main body case being provided with a manual key arrangement on an inner surface thereof, the lid case having a liquid crystal display device incorporated therein and comprising a transparent or semitransparent image display screen, the lid case having an inner surface including an inner display surface opposed to the screen of the display device, the lid case having a rear surface including an outer display surface opposed to the screen of the display device, the portable telephone enabling the user to observe normally the display image of the display device through either of the display surfaces by reversing the display pattern of the display device in response to the lid case to be opened or closed.

2. A foldable portable telephone according to claim 1 wherein the body case or the lid case is provided with a folding detection switch being turned on / off in response to the lid case to be opened or closed, and the display pattern of the liquid crystal display device is automatically displayed as reversed corresponding to on /

off signal transmitted by the detection switch.

FIG. 1 (a)

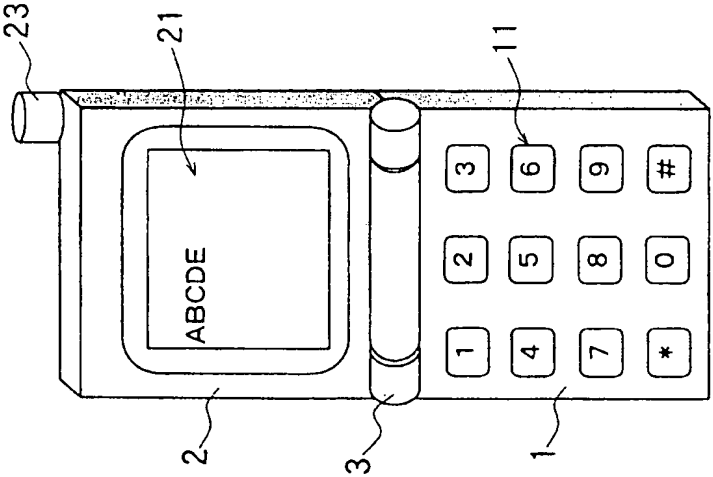


FIG. 1 (b)

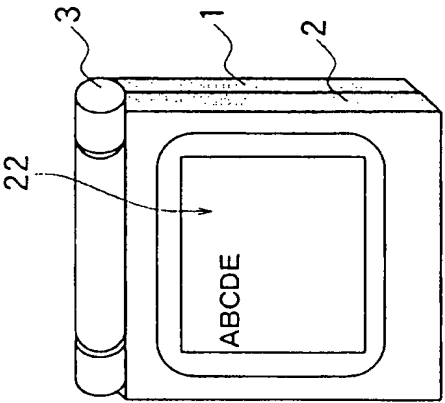


FIG. 3

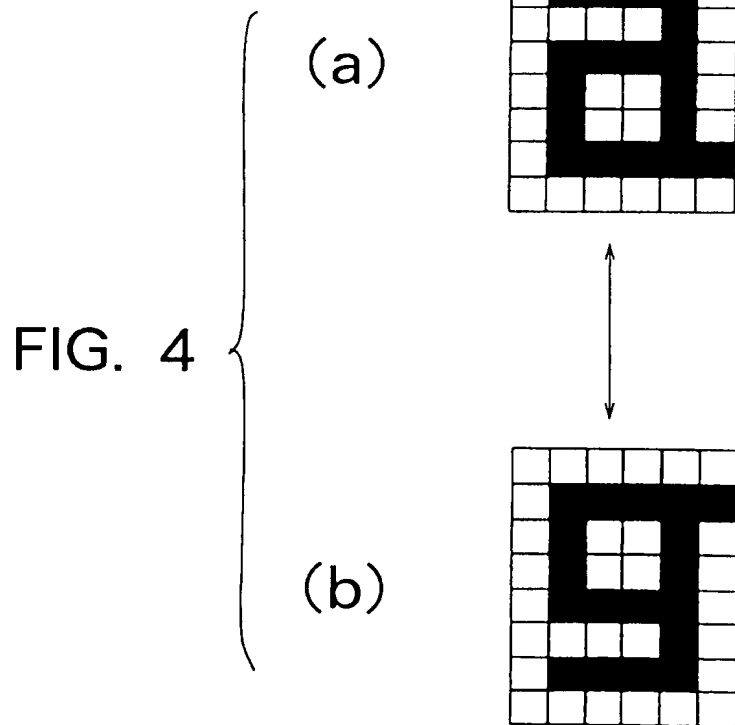
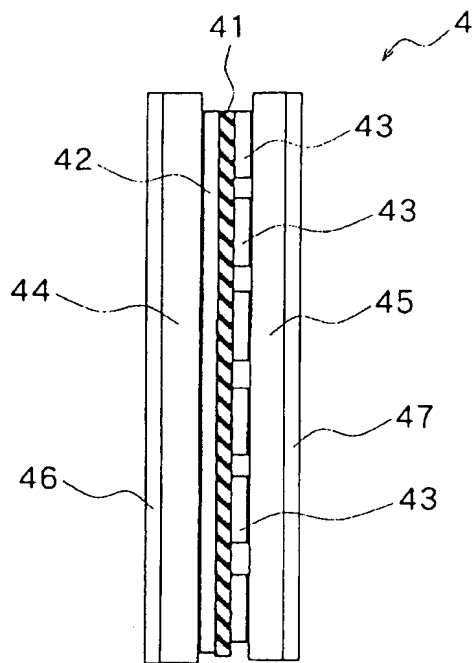


FIG. 5

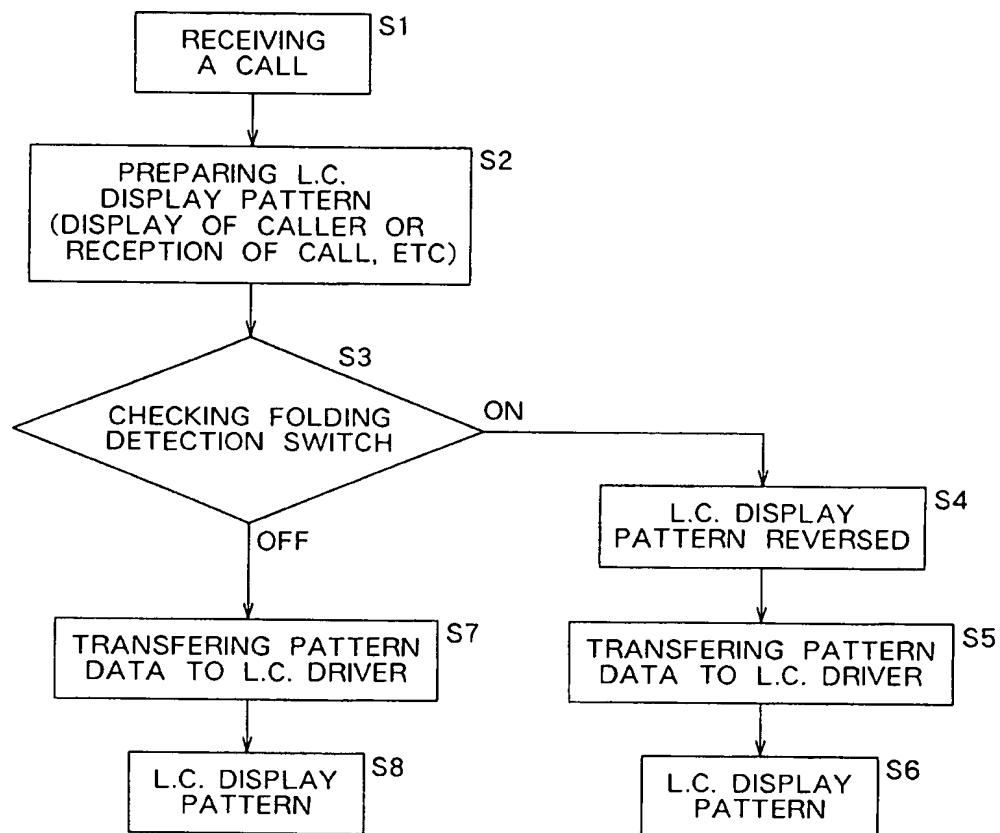


FIG. 6

